

NEW FOSSIL MOLLUSKS FROM THE MIOCENE OF VIRGINIA AND NORTH CAROLINA, WITH A BRIEF OUTLINE OF THE DIVISIONS OF THE CHESAPEAKE GROUP

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The purpose of this paper is to briefly outline the different divisions of the Chesapeake group of the Miocene epoch in Virginia and to describe and illustrate seven new species and five new subspecies of mollusks occurring in some part of this group.

I wish to express my sincere thanks to the officials of the United States National Museum for the facilities offered by this institution in the use of former collections. The types of the described mollusks are deposited in the United States National Museum.

DIVISIONS OF THE CHESAPEAKE GROUP

Inasmuch as a more complete discussion of the divisions of the Chesapeake group is to be published under the heading "Summary of the Miocene stratigraphy of Virginia based upon the study of the fauna" in a volume forming a number of the *George Washington University Bulletin*, it is undesirable to give here more than a brief outline.

The following divisions are recognized:

Chesapeake group	Yorktown formation	{	Zone 2, or <i>Turritella alti-</i>	{	upper part
		costata zone	middle part		
		{	Zone 1, or <i>Pecten clintonius</i> zone		lower part
	St. Marys formation	{	Zone 2, or <i>Crassatellites meridionalis</i>		
		zone	{	Zone 1, or <i>Bulliopsis quadrata</i> zone	
		{	Stratum A		
	Choptank formation				
	Calvert formation				

The Calvert formation constitutes the lower part of the Chesapeake group. The material composing this formation consists of dark-gray or olive sandy, usually diatomaceous clay.

The Choptank formation, where recognized, overlies the Calvert. The materials composing this formation consist of dark-brown rather soft sand and greenish-gray clayey sand alternating with indurated sandstone layers.

The St. Marys formation is divided into three parts. The lower part, or stratum A, consists of a nearly unfossiliferous dark sandy plastic clay. The overlying fossiliferous parts are divided into two faunal zones—zone 1, or *Bulliopsis quadrata* zone, constituting the lower fossiliferous part, and zone 2, or *Crassatellites meridionalis*, the overlying part.

The Yorktown formation is separated into two faunal zones—zone 1, or *Pecten clintonius* zone, for the lower part; and zone 2, or *Turritella alticostata*, for the overlying part.

Zone 1 includes, in part, the "Murfreeshoro stage" of Olsson.¹ The term Murfreeshoro is preoccupied, being used by Safford and Killebrew² to designate the lowest limestone of the Central Basin of Tennessee. As the fauna of this zone is more closely related to the fauna of the Yorktown formation than to that of the St. Marys formation, I have placed the zone as the basal part of the Yorktown.

Zone 2 of the Yorktown formation is again divisible into three minor divisions. The lower part underlies the fragmental beds; the middle part, the fragmental beds; and the upper part overlies the fragmental beds and represents the latest deposit of the Yorktown formation in Virginia.

DESCRIPTIONS OF NEW SPECIES³

Class GASTROPODA

CLATHRODRILLIA? BELLOIDES RUSHMERENSIS, new subspecies

Plate 1, figure 4

Shell small, rather solid, moderately slender, prominently axially and finely spirally sculptured, and consisting of six remaining whorls—nucleus broken away. Whorls expanded medially, constricted at the sutural zone. Suture appressed. Anal fasciole wide, shallowly depressed, undulated anteriorly by the rising ribs. Axial sculpture of (on the body whorl, nine) strong, rounded, protractive

¹ Olsson, Axel, Bull. Amer. Paleontology, vol. 5, pp. 155-163, 1917.

² Safford, J. M., and Killebrew, J. B., Elements of Geology of Tennessee, p. 125, 1900.

³ The photographic illustrations were made in the laboratory of the United States Geological Survey by Mr. W. O. Hazard and the retouching of the prints by Miss Frances Wieser of the section of illustrations of the same bureau.

ribs, extending from the anal fasciole forward to the suture on the spire whorls and to the base on the body whorl. Spiral sculpture of narrow bands on the whorls in front of the anal fasciole; on the early whorls these are narrow, closely set, and occasionally intercalated with a spiral thread; on the later whorls, especially over the base, the bands are wider and usually intercalated with a finer spiral. Spiral sculpture within the anal fasciole of fine closely set threads. One or two slightly heavier threads lie in front of the suture. The spiral sculpture over the whole surface of the shell is minutely roughened by axial growth-lines. Aperture wide, subovate in form. Anal notch wide and deep. Outer lip thin, slightly inflected at the lower part. Columella and parietal wall with a heavy wash of callus. Siphonal canal short, anteriorly bent backward.

Dimensions.—Type (Cat. No. 352436, U.S.N.M.), altitude, 11 mm.; greatest diameter, 4 mm.; length of aperture, 4 mm.; width of aperture, 1.8 mm.

Type locality.—U. S. G. S. Station 1/236, Rushmere Wharf, on James River, Va., highest bed exposed. (W. C. Mansfield, collector.)

The new subspecies differs from *Clathrodrillia? belloides* (Olsson), described from the Yorktown formation, James River above Smithfield, Va., in having fewer, stronger, and more protracted axials.

Occurrence.—Yorktown formation, middle part of the *Turritella alticostata* zone; known only from type locality.

FUSINUS (BUCCINOFUSUS) PROPEPARILIS, new species

Plate 1, figures 5, 9

Shell of moderate size, fusiform, solid, axially and spirally sculptured. Whorls rapidly enlarging, rounded, moderately constricted at the suture. Suture appressed and undulating. Subsutural area wide and shallowly excavated. Axial sculpture of (on the penultimate whorl, twelve) strong, rounded, vertical ribs, strongest over the periphery of the whorl. These ribs do not descend to the base on the first half of the body whorl and become obsolete over the last half. Whole surface axially marked by fine growth lines, all the spirals being rugose. Spiral sculpture of five to six primary threads, beginning on the posterior slope and extending forward to the suture. There are about 26 of these spirals on the last whorl and the canal. Besides the primary spirals, secondary threads varying in strength intercalate the primary spirals and ornament the rest of the surface. On approaching the end of the canal these secondaries become stronger and are reduced to two or three in number. Aperture ovate. Canal long and reflexed anteriorly. Columella coated with callus along the border and side of the siphonal canal.

Dimensions.—Type (Cat. No. 370828, U.S.N.M.), altitude, 83 mm.; greatest diameter, 28 mm.

Type locality.—U. S. G. S. station 1/473a, Bellefield, Va., basal bed. (W. C. Mansfield, collector.)

The new species is related to *Fusinus parilis* (Conrad), a species in the St. Marys formation, but Conrad's species is a stouter shell, having a proportionally larger body whorl. The spirals, also, on the St. Marys species are much stronger and the subsutural area is less excavated and more coarsely spirally marked.

Occurrence.—Yorktown formation, zone 1, Grove Wharf (old wharf), James River, Va., lowest bed exposed. (Collected by Dr. Frank Burns, 1892, and by W. C. Mansfield, 1923.)

PISANIA (CELATOCONUS) BURNSI, new species

Plate 1, figures 1, 3

Shell solid, elongate-ovate, body whorl about twice as long as spire, consisting of about five whorls—apical whorls decorticated. Sutural area moderately depressed, suture close-fitting, shallowly and narrowly channeled. Sculpture of (on the body whorl, 23) seminodulous, nearly flat, brown spiral bands separated by areas of about half their width. Over the basal slope of the body whorl a spiral line intercalates the bands. Growth lines overrun the spirals and interspaces and give a faint reticulate ornamentation to the shell. Aperture elongate-ovate. Margin of outer lip partly broken away; within ornamented with about 11 lirae. Parietal wall and columella with a wash of callus. Columella twisted, anteriorly ornamented with a rather strong fold. Siphonal fasciole well developed, provided with an elongated chink in front.

Dimensions.—Type (Cat. No. 352437, U. S. N. M.), altitude, 28 mm.; greatest diameter, 13 mm.; length of aperture, 15 mm.

Type locality.—U. S. G. S. station 3915, river front at Urbanna, Va. (Frank Burns, collector, 1903.)

The new species is related to *Pisania nux* Dall but is a heavier shell, has a less reticulate sculpture ornamentation and a stronger and better developed siphonal fasciole than Dall's species. The new species is named after the collector, Dr. Frank Burns.

Occurrence.—St. Marys formation, zone 2, only known from type locality.

COLUMBELLA (SEMINELLA) SMITHFIELDENSIS, new species

Plate 1, figures 6, 7

Shell small, stout, rather fragile, spirally sculptured, having body whorl longer than spire, consisting of $1\frac{1}{2}$ nuclear and three post-

nuclear whorls. Nuclear whorls large, smooth, moderately inflated, constricted at the suture, apical one bluntly rounded. Post-nuclear whorls rather rapidly enlarging and broadly rounded in outline. Suture grooved, not appressed. Sculpture of (on the penultimate whorl, five) slightly raised, paired, spiral lines, the individual lines composing each pair being separated from each other by a narrow groove and the pairs from each other by an interspace about equal to their width. The spirals extend forward to the end of the canal. Very fine axial growth lines connect the paired spirals. Aperture elongate-subovate, outer lip thin, margin crenulate. Pillar at its lower margin provided with a fold, forming the inner and upper edge of the short and curved siphonal canal. The new species may not be mature.

Dimensions.—Type (Cat. No. 352438, U. S. N. M.), altitude, 3.8 mm.; diameter, 1.6 mm.; length of aperture, 1.5 mm.; width, 0.7 mm.

Type locality.—U. S. G. S. station 1/205, uppermost bed in section along a small stream flowing into Tormentor Creek, about 2 miles north of Smithfield, Va. (W. C. Mansfield, collector.)

Occurrence.—Yorktown formation, zone 2, middle part; only known from type locality.

EPITONIUM SMITHFIELDENSIS, new species

Plate 1, figure 10

Shell of medium size, stout, delicately ornamented with slender varices, consisting of seven remaining whorls—nucleus decollate. Whorls well rounded, gradually and evenly enlarging, and very strongly constricted at the deeply grooved suture. Sculpture of (on the last whorl, 12) wide, very thin, marginally reflected retractive varices, the margins being cuspidate at the posterior third and ends fused to the preceding and succeeding varices. The varices extend diagonally across the whorl and, followed successively up the spire, make about a half-turn around the axis. No other ornamentation is present. Aperture orbicular in shape, outer margin formed by the terminal varix and inner margin by a thin lamina adhering to the varices.

Dimensions.—Type (Cat. No. 352440, U.S.N.M.), altitude, 12 mm.; greatest diameter, 5 mm.; greatest diameter of aperture, 2.2 mm.

Type locality.—U. S. G. S. station 1/205, uppermost bed in a section along small stream flowing into Tormentor Creek about 2 miles north of Smithfield, Va. (W. C. Mansfield, collector.)

Occurrence.—Yorktown formation, zone 2, middle part. Only known from the type locality.

FOSSARUS (ISAPIS) URBANNAËNSIS, new species

Plate 1, figures 2, 8

Shell large, turbinate, tabulated at the shoulder, spire high for genus, consisting of about three whorls, early whorls decorticated. Suture deep and grooved. Spiral sculpture on body whorl consists of a faint line on the posterior slope and three strong elevated, equally-spaced ridges on the periphery, the posterior two being weaker and slightly marginally reflected, the anterior one stronger, nearly flat-topped, and coronated. Base with three spirals, anterior two stronger; anterior one surrounds the umbilicus. Fine granulose spirals override the strong ridges and the irregular transverse growth lines. Aperture nearly round, axial diameter a little greater. Outer margin of aperture undulating in conformity to spiral sculpture, inner margin slightly reflected over the umbilicus.

Dimensions.—Type (Cat. No. 352439, U.S.N.M.), altitude, 7 mm.; diameter, above the aperture, 5.2 mm.; axial diameter of aperture, 3.5 mm.

Type locality.—U. S. G. S. station 3915, river front at Urbanna, Va. (Frank Burns, collector, 1903.)

Fossarus dalli Whitfield is related to the new species but lacks the fine granulose spirals, has a less angled basal slope, and stronger transverse sculpture crossing the strong spirals.

Occurrence.—St. Marys formation, zone 2. Known only from type locality.

Class PELECYPODA

PECTEN EBOREUS URBANNAËNSIS, new subspecies

Plate 2, figure 2; plate 3, figure 2

The type locality of *Pecten eboreus* Conrad⁴ is Suffolk, Va. Dall⁵ classified different mutations of the species and designated each by a varietal name. The form occurring at Suffolk he designated *Pecten eboreus eboreus*.

The new subspecies differs from the Suffolk form as follows: The ribs are lower and are separated by a shallower and less distinct interspace. Two to three fine radials lie within these interspaces. The ears are larger, the byssal notch deeper, and the radials on the ears are finer and less distinct. The new subspecies is an intermediate form between *P. madisonius* Say and *P. eboreus eboreus* Conrad.

Dimensions.—Cotypes (Cat. No. 370829, U.S.N.M.), right valve, latitude, 107 mm.; altitude, 97 mm.; diameter, 17 mm. Left valve of

⁴ Conrad, T. A., Amer. Journ. Sci., ser. 1, vol. 23, p. 341, 1833.

⁵ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 4, p. 750, 1898.

another specimen, latitude, 104 mm.; altitude, 98 mm., diameter, 20 mm.

Occurrence.—St. Marys formation, zone 2. U. S. G. S. station 3915, Urbanna, Va. (type locality); U. S. G. S. station 1/476a, Lanexa, Va., lower bed; U. S. G. S. station 1/233, Scotland Wharf, Va., right bank of James River, bed 10 to 16 feet above beach; U. S. G. S. station 1/540, Schmidts Bluff, right bank of James River, Va., lowest bed; Mount Folly, right bank of York River, Va.

THRACIA (CYATHODONTA) DALLI, new species

Plate 4, figures 1, 2

Shell of medium size, thin, translucent, inequilateral—anterior side being longer, right valve larger than left and more inflated. Right valve rounded on anterior side and over the middle of disk and slightly depressed in front of the posterior ridge; left valve slightly depressed medially. Posterior dorsal slope on each valve gradually descending, medially depressed, bordered above by a low ridge extending from the beak to the lower posterior angle, and below by a lower ridge. Posterior dorsal margin nearly straight and oblique; posterior margin truncate; anterior dorsal and basal margins evenly rounded. Sculptured externally by coarse concentric rounded ridges, which are nearly obsolete over the posterior dorsal slope; radially sculptured by faint granulate threads, which are more closely set and more prominent over the posterior dorsal slope. Internally, the external concentric sculpture is reflected. Hinge strongly developed for the genus.

Dimensions.—Type (Cat. No. 352442, U.S.N.M.), right valve, latitude, 34 mm.; altitude, 25 mm.; diameter, 9 mm.; left valve, latitude, 33 mm.; altitude (margin broken away), 22 mm.; diameter, 5 mm.

Type locality.—U. S. G. S. station 1/202, about one-fourth mile northeast of Benns Church, Isle of Wight County, Va. (W. C. Mansfield, collector.)

The new species is related to *Thracia (Cyathodonta) semirugosa* Reeve, which species has been reported by Dall^o as occurring in the Pliocene marl of the Caloosahatchee River, Fla., and living in the Caribbean Sea. Reeve's species possesses a less oblique posterior dorsal margin and is much less inflated anteriorly than the new species here described.

The species is named in honor of Dr. W. H. Dall.

Occurrence.—Yorktown formation, zone 2, middle part.

^o Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1526, 1903.

PANDORA (CLIDIOPHORA) CONRADI, new species

Plate 5, figures 4, 5

The specimen consists of attached valves, which have been slightly compressed by the impact of incumbent sediments.

Shell of medium size, subovate in form, thin, inequivalve, and inequilateral, having a strong posteriorly protruding marginal rostrum. Anterior side proportionally rather long for the genus. Anterior margin evenly and narrowly rounded; basal margin broadly rounded. Escutcheon extending nearly to the posterior extremity of valves. Sculpture of fine, close, concentric lines and a few faint diverging radials.

Dimensions.—Type (Cat. No. 352441, U.S.N.M.), greatest latitude, 35 mm.; altitude, 16 mm.; diameter, 4 mm.

Type locality.—U. S. G. S. station 1/221, near the bottom of a small ravine entering Blackwater River and about a quarter of a mile from it and about 1½ miles northwest of Walters, Va.

The new species here described differs from *P. crassidens* Conrad in possessing a proportionally longer anterior side and a much stronger and more protruding rostrum.

Occurrence.—Yorktown formation, zone 2. Known only from the type locality.

CRASSATELLITES (CRASSATELLITES) MERIDIONALIS SURRYENSIS, new subspecies

Plate 5, figures 3, 6

Shell large, solid, ovate, and nearly equilateral, the posterior side being somewhat longer. Outline of anterior, ventral, and posterior margins rounded, the anterior margin slightly more broadly rounded than the posterior. Posterior-dorsal angle obtuse, not ridged, in front of which the disk is weakly constricted. A weak radial is halfway between the shoulder and the border of the escutcheon. Lunule and escutcheon prominent and impressed, the escutcheon a little longer, wider, and more curved than the lunule. Nepionic shell slightly flattened and marked by about 10 moderately strong concentric undulations continued on a radius of about 10 millimeters. The rest of the surface is nearly smooth. The hinge is normal.

Dimensions.—Type—left valve (Cat. No. 370832, U.S.N.M.), latitude, 93 mm.; altitude, 70 mm.; diameter (1 valve), 18 mm.

Dall⁷ placed *meridionalis* as a variety of *Crassatellites melinus* (Conrad). I have raised his variety to specific rank. The new subspecies is a higher and more equilateral shell than the species

⁷ Dall, W. H., Wagner Free Inst. Sci. Trans., vol. 3, pt. 6, p. 1473, pl. 37, figs. 6, 13, 1903.

meridionalis; the posterior extremity is less pinched and the nepionic shell has coarser and shorter radially extending undulations.

Type locality.—U. S. G. S. station 1/241, right bank of James River 1½ miles below Claremont Wharf, Va., from lowest bed.

Occurrence.—St. Marys formation, zone 2, type locality, and at the following localities: U. S. G. S. station, 1/543, about 1 mile below type locality, from lowest bed; U. S. G. S. station 1/241, right bank of James River, Cobham Bay, bed outcropping at water level.

CRASSATELLITES (CRASSATELLITES) MERIDIONALIS URBANNAËNSIS, new subspecies

Plate 4, figures 3, 4

Shell large, moderately thin, low, subovate and inequilateral, the posterior side being longer and more attenuated. Outline of anterior margin narrowly rounded, ventral margin broadly rounded, and posterior margin short and narrowly rounded. Dorsal-posterior shoulder angle obtuse. Disk slightly depressed in front of the shoulder. Nepionic shell slightly flattened and marked by rather closely set undulations continuing radially 7 to 9 millimeters. Surface of disk smooth except for growth lines.

Dimensions.—Type—right valve (Cat. No. 370831, U.S.N.M.), latitude, 100 mm.; altitude, 69 mm.; diameter, 17 mm.

The new subspecies has a lower and larger shell than *Crassatellites meridionalis*. Its posterior extremity is less truncated and less depressed in front of the dorsal posterior shoulder. The nepionic shell has fewer undulations. This subspecies differs from the new subspecies *surryensis* in having a more inequilateral shell and a shorter radial continuation of nepionic undulations.

Occurrence.—St. Marys formation, zone 2, U. S. G. S. station 3915, Urbanna, Va., type locality; U. S. G. S. station 3924, Jones Point, Rappahannock River, Va.

PHACOIDES (LUCINOMA) CONTRACTUS MURFREESBOROËNSIS, new subspecies

Plate 5, figures 1, 2

Shell suborbicular, convex, fragile, equivalve, and nearly equilateral. Beaks low, apices proximate. Posterior dorsal margin straight and oblique, anterior dorsal margin slightly depressed; posterior, anterior, and basal margins well rounded. Sculpture of rather closely set, nearly erect, slightly beakward reflected, concentric primary lamellae, intercalated with about two weak secondary threads.

Dimensions.—Type (Cat. No. 352443, U.S.N.M.), latitude, 28 mm.; altitude, 27 mm.; diameter of both valves, 15 mm.

Type locality.—U. S. G. S. station 1/222, right bank of Meherrin River at Murfreesboro, N. C., basal bed exposed at water level and a little above. (W. C. Mansfield, collector.)

The new subspecies differs from the species mainly in having much closer and stronger concentric primary lamellæ and fewer secondary intermediate spiral threads. Is also much smaller. The dimensions are proportionally the same.

Occurrence.—Yorktown formation, zone 1. Known only from type locality.

EXPLANATION OF PLATES

PLATE 1

- FIGS. 1, 3. *Pisania (Celatoconus) burnsi*, new species ($\times 2$); type; alt. 28 mm.; page 4.
- 2, 8. *Fossarus (Isapis) urbanaënsis*, new species ($\times 8$); type; alt. 7 mm.; page 6.
4. *Clathrodrillia? belloides rushmerensis*, new subspecies ($\times 8$); type; alt. 11 mm.; page 2.
- 5, 9. *Fusinus (Buccinofusus) propeparilis*, new species. Fig. 5 ($\times 3$), fragment of the early whorls of a specimen collected by Frank Burns at Grove Wharf, lower bed, left bank of James River (Cat. No. 146148, U.S.N.M.); Fig. 9, type ($\times 1\frac{1}{2}$); alt. 83 mm.; page 3.
- 6, 7. *Columbella (Seminella) smithfieldensis*, new species ($\times 8$); type; alt. 3.8 mm.; page 4.
10. *Epitonium smithfieldensis*, new species ($\times 3$); type; alt. 12 mm.; page 5.

PLATE 2

- FIG. 1. *Pecten madisonius* Say, variety (natural size): Left valve of another show the form occurring in the same bed with *Pecten eboreus urbanaënsis*. Collected from zone 2, St. Marys formation, at Grays Creek, Surry County, Va. (Cat. No. 370830, U.S.N.M.)
2. *Pecten eboreus urbanaënsis*, new subspecies (natural size): Right valve of cotype; latitude 107 mm.; page 6.

PLATE 3

- FIG. 1. *Pecten madisonius* Say, variety (natural size): Left valve of another specimen from the same locality as specimen, fig. 1, plate 2.
2. *Pecten eboreus urbanaënsis*, new subspecies (natural size): Left valve of cotype; latitude 104 mm.; page 6.

PLATE 4

- FIGS. 1, 2. *Thracia (Cyathodonta) dalli*, new species ($\times 1\frac{1}{2}$); type. Fig. 1, left valve; latitude 33 mm.; Fig. 2, right valve; latitude 34 mm.; page 7.
- 3, 4. *Crassatellites (Crassatellites) meridionalis urbanaënsis*, new subspecies; type. Fig. 3, right valve, natural size; latitude 100 mm.; Fig. 4, beak of same specimen ($\times 5$); page 9.

PLATE 5

- FIGS. 1, 2. *Phacoides (Lucinoma) contractus murfreesboroënsis*, new subspecies.
Fig. 1, right valve of type ($\times 3$); latitude 28 mm.; Fig. 2, left valve of topotype ($\times 2$); page 9.
- 3, 6. *Crassatellites (Crassatellites) meridionalis surryensis*, new subspecies; type. Fig. 6, left valve (natural size); latitude 93 mm. Fig. 3, beak of same specimen ($\times 5$); page 8.
- 4, 5. *Pandora (Clidiophora) conradi*, new species ($\times 1\frac{1}{2}$); type; latitude 35 mm.; page 8.

